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ZIPPER BEAR CLOSURE ENDURANCE TESTING

15 DAAK11-79-C-0066

TASK ORDER NO. 11

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A manned endurance test program of 22 two hr. tests was conducted to verify the reliability of the DPE Outergarment Zipper Rear Closure developed under task order nine of this contract. Testing indicates that the closure assembly reliably provides a positive seal in the rear of the Outergarment as it is actually worn and used.		

INTRODUCTION

Task Order 9 of Contract DAAK11-79-C-0066 authorized the development of a zipper rear closure for the DPE Outergarment. This development is complete and documented in the final report of 28 May 1981 Design of Zipper Rear Closure.

The task reported herein was authorized to conduct endurance testing of the closure assemblies when installed in a DPE type Outergarment. Endurance testing of the closure assembly in a simulated use scenario generates reliability information that is essential before the assembly can be incorporated into DPE Outergarments.

TEST PROGRAM

The endurance test program consisted of twenty-two two hour tests conducted on DPE type outergarments with zipper rear closures. The tests were two hours long since that is the duration of most actual DPE usages. Twenty-two such tests without failure demonstrate .90 reliability at a 90% confidence level.

The endurance test plan was similar to endurance testing first used to verify the DPE design. The test plan is included in Attachment 1. Testing included:

- 1) A series of exercise movements performed in place
- 2) A sequence of activities simulating actual use, including climbing and descending stairs, lifting and moving 20 lb. weights, opening and closing a valve, using a wrench and screwdriver, and handling hoses.
- 3) Walking on a treadmill.

The zipper rear closure was examined after each test, and any damage or wear noted. Also, the outergarment was inflated after each test and visually examined for any

indication of leakage. Two DPE type outergarments were used for the endurance tests.

TEST RESULTS

TEST NO.	DAMAGE OR WEAR	INFLATION EXAMINATION
1	None	Positive, No detectable leakage
2	None	Positive, No detectable leakage
3	None	Positive, No detectable leakage
4	None	Positive, No detectable leakage
5	None	Positive, No detectable leakage
6	None	Positive, No detectable leakage
7	None	Positive, No detectable leakage
8	None	Positive, No detectable leakage
9	None	Positive, No detectable leakage
10	None	Positive, No detectable leakage
11	None	Positive, No detectable leakage
12	None	Positive, No detectable leakage
13	None	Positive, No detectable leakage
14	None	Positive, No detectable leakage
15	None	Positive, No detectable leakage
16	None	Positive, No detectable leakage
17	None	Positive, No detectable leakage
18	None	Positive, No detectable leakage
19	None	Positive, No detectable leakage
20	None	Positive, No detectable leakage
21	None	Positive, No detectable leakage
22	None	Positive, No detectable leakage

There was no observed variation in the closure assembly performance throughout the test program. The closure assembly exhibited no signs of wear or damage as a result of the simulated usage scenarios. The closures repeatedly provided a positive seal to the outergarment, as indicated by the inflation examination results. Suit subjects reported that the installation of the closure assemblies in the outergarments resulted in no interference with suit motions or any normal operation of the ensemble.

Conclusions

This endurance test program has demonstrated the reliability of the rear zipper closure when installed in DPE type outergarments in actual use scenarios. It indicates that the closure can positively seal the outergarment for a two hour usage, and is not readily damaged by any anticipated suit activities.

ATTACHMENT 1

ENDURANCE TEST PLAN, ZIPPER REAR CLOSURE, DPE TYPE OUTERGARMENTS

Purpose - This plan establishes the test methods and requirements for DPE Type Outergarments with zipper rear closures. The endurance tests are performed to determine that the Outergarments with zipper rear closures provide optimum physical endurance.

Test Procedure - The endurance tests are to be two hours in length consisting of a 40-minute treadmill test, a 40-minute exercise period, and a 40-minute work period.

The treadmill test will be run for 40 minutes. The work schedule will be 1 minute on and 2 minutes off the treadmill during the 40-minute test cycle. The treadmill speed will be 2-3 mph at a 15° angle of incline.

The exercises will consist of:

1. Kneel, of left knee, kneel of both knees, reach behind
2. Duck squat, pivot left, pivot right
3. Stand erect, bend forward at waist 90°
4. Stand erect, extend arms overhead, then bend elbows
5. Stand erect, extend arms perpendicular to torso, twist waist left and right

Repeat the above sequence for 15 minutes, rest for 5 minutes. Continue for 40 minutes. (Two work/rest cycles.)

The work tests will consist of:

1. Stack 20 lb. boxes on table
2. Uncoil and coil hose
3. Climb stairs with bucket, 6 steps up-down
4. Place barrel on hand truck and move 25 feet
5. Open overhead valve
6. Remove and install bolt with wrench
7. Remove and install screw with screwdriver

Repeat the above sequence for 15 minutes, rest for 5 minutes. Continue for 40 minutes. (Two work/rest cycles.)

The test will be paced to simulate moderate to heavy work load. The endurance test will be terminated on:

1. Request of subject
2. Indications of fatigue or heat stress from telemetry
3. Request of test conductor or physiological monitor
4. Completion of the endurance test requirements